Introduction to Biotechnology

Biotechnology

- Biotechnology helps to meet our basic needs.
- Food, clothing, shelter, health and safety

Biotechnology

- Improvements by using science
- Science helps in production plants, animals and other organisms

Biotechnology

- Also used in maintaining a good environment that promotes our well being

Biotechnology

- Using scientific processes to get new organisms or new products from organisms.

Biotechnology

- Large area
- Includes many approaches and methods in science and technology

Office of Tech

Assessment Definition

- Any technique that uses living organisms or substances from those organisms to make or modify a product, to improve plants or animals….

Cont.

- Or to develop microorganisms for specific uses.

Agricultural View

- All of the applied science based operations in producing food, fiber, shelter, and related products

Agricultural View

- Milk production
- New horticultural and ornamental plants
- Wildlife, aquaculture, natural resources and environmental management

Multidisciplinary

- Involves many disciplines or branches of learning
- Includes all areas of Life Sciences

Organismic Biotech

- Working with complete, intact organisms or their cells
- Organisms are not genetically changed with artificial means

Organismic Biotech

- Help the organism live better or be more productive
- Goal – improve organisms and the conditions in which they grow

Organismic Biotech

- Study and use natural genetic variations
- Cloning is an example of organismic biotech

Cloning

- Process of producing a new organism from cells or tissues of existing organism.
- 1997 cloned sheep – “Dolly” in Edinburgh Scotland

Molecular Biotech

- Changing the genetic make-up of an organism
- Altering the structure and parts of cells
- Complex!

Molecular Biotech

- Uses genetic engineering, molecular mapping and similar processes

Genetic Engineering

- Changing the genetic information in a cell
- Specific trait of one organism may be isolated,cut, and moved into the cell of another organism

Transgenic

- Results of Gen. Eng. Are said to be “transgenic”
- Genetic material in an organism has been altered

Biotech examples

- Medicine
- Agriculture
- Environment
- Forestry
- Food and beverage processing

Medicine

- Some new developments delve into the hereditary material of humans known as gene therapy

Medicine

- Therapeutant - product used to maintain health or prevent disease
- Biopharmaceuticals – drug or vaccine developed through biotechnology
- Called designer drugs

Medicine

- Biopharming – production of pharmaceuticals in cultured organisms
- Combination of the agriculture and pharmaceutical industries

Medicine

- Certain blood – derived products needed in human medicine can be produced in the milk of goats

Environment

- Any biotechnological process that may promote a good environment
- Organisms developed during the gulf war to “eat” oil
- Organism used in gold mining to “eat” contaminants

Environmental

- Problems naturally solved by microorganisms such as bacteria, fungi break down contaminant into a form less harmful or not harmful

Ag and Forestry

- Plant biotech
- Animal biotech

Plant biotech

- Improve plants and the products produced from them
- Insect and disease resistance
- Engineered to have desired characteristics

Plant biotech

- Corn plant produced with high levels of the amino acid Lysine

Animal Biotech

- Improve animals or the products they produce
- Animals may be used to produce products that promote human health

Animal Biotech

- Increase productivity
- Pigs engineered to produce human hemoglobin

Food and Beverages

- Use of technology in producing and processing
- Some biotech principles have been employed for hundreds of years
- Yeast in baking bread

Food and Bev.

- Genetically altered crops
- rBGH milk

Biotechnology

- Helps meet human needs
- Food, clothing and shelter
- Plants and animals are used in manufacturing food, clothing and materials for shelter

Biotechnology

- Used to make products more useful or desirable
- Ex: conversion of milk into cheese or yogurt

Efficiency

- Must keep the cost of improving products as low as possible
- Biotech results in greater efficiency

Efficiency

- Inoculating legume seeds with bacteria that allow the plant to pull nitrogen out of the air and put it into the soil
- Saves the producer the cost of applying N fertilizer

Efficiency

- Results in trees that grow faster and produce wood that is more desirable

Greater Production

- Increases yields
- bST use in cows to produce more milk
- Higher crop yields from drought, disease & insect resistant crops

Health Promoting Foods

- Food with unique traits
- Some contain therapeutants
- Some designed with nutrient enrichment

Safety

- Consumers want foods to provide needed nutrients and in some cases, enhanced foods
- Do not want side effects from those enhanced foods

Easy preparation

- Flavr-Savr Tomato
- Reached the market in early 1990's
- Engineered to have a longer shelf life

Flavr-Savr

- No soft spots
- No rotten spots
- Tomato resists spoilage

Synthetic biology

- Creating lifelike characteristics through the use of chemicals
- Based on creating structures similar to those found in living organisms

Synthetic Biology

- Need for synthetic cells lead to the development of the vesicle
- Vesicle – tiny rounded structure with cell like traits

Vesicle

- Tiny structures similar to soap bubbles were created to serve as the cell membrane
- Visible only with powerful microscope

Vesicle

- Once the cell membrane has been successfully developed, development of the materials with the cell is initiated.

Synthetic biology

- Is important because it brings science closer to creating life in the lab
- Cells and tissues may be developed to treat human injury and disease